TRANSPORTATION MODELING FORUM

December 11, 2019
Forum Agenda

• Welcome, Introductions and Announcements
• Model Roadmap
  – Development
  – Application
  – Surveys
  – Sketch Planning
• How to model the 5 Big Moves
Model Roadmap

Wu Sun
Cherry Liu
Rick Curry
Mike Calandra
Cedric Goddevrind (Deloitte)
Model Roadmap

• Model Development
• Model Application
• Surveys in 2019
• Sketch Planning
Model Development

• Roadmap for the 2025 Regional Plan
  – 4-year development cycle
  – Multiple tools for a wide spectrum of transportation analysis
  – Fast, reliable, reproducible, easy to maintain, user friendly, and reflective of changing environment

• Contingent on budget, time, & staffing
Spectrum of Modeling Tools

• Sketch planning tools for strategic analysis
• Travel demand model for long range regional planning
• Customized travel demand model for sub-regional planning
• Project evaluation tools for operational level analysis
Sketch Planning Tools

FutureScape
- Highway and transit network investment impact
- Visualization

Other possible tools (e.g. VisionEval)
- Land use
- Emerging transportation technologies/modes

Integrated sketch planning
- An integrated platform for quick evaluation of network, land use, emerging transportation policy and technology changes

Risk analysis/Range-based forecasting
- Expand FHWA/SANDAG TMIP-EMAT project
- Link with the sketch planning tool to produce range-based forecasting
Long Range Regional Planning-Core Model

ABM3 (10/2020-06/2023)

- New software platform-ActivitySim
- Complete demand side modeling update
  • Estimation, implementation, calibration, validation, & sensitivity tests
- Possible new model components, including but not limited to:
  • Transit pass model
  • University student model
  • Military travel model
- Supply side modeling update
  • Faster network building, skimming & assignments to achieve significantly reduced model runtime
- Data model/structure
  • Input and output management
  • Monitoring and reporting
- Cloud-based?
Long Range Regional Planning-Special Market Models

Special Market Model Highlights

- Cross-border model update (02/2020-07/2021)
  - First project to transition from Java-based CTRAMP to Python-based ActivitySim
- Commercial vehicle model (07/2021-06/2023)
  - Fully integrated with ABM3 core model with explicit E-commerce/online shopping modeling

Other Special Market Model Update

- External models
- Airport model
- Visitor model
- Heavy truck model
• Automated, integrated, and streamlined reporting & monitoring system
• Integrated transportation and land use modeling platform
• Survey/Big data informed behavioral data fusion system
• Optimized observed data/traffic count management system
  – Highway counts
  – Arterial counts (MS2)
  – Transit ridership counts
  – ACS/Census
Model Application

• Board policy
  – May 2017 Executive Committee decision (covered during the June 2017 Model Forum)
    • Support the current and previous model only
    • Expiration date tied to Board adoption of Regional Plans (RP)
  – Regional plans
    • 2015 Regional Plan and Sustainable Community Strategy (SCS)
    • 2019 Federal Regional Transportation Plan (RTP)
    • 2021 Regional (Vision) Plan and SCS
  – Cycle interruption
    • The 2019 Regional Plan was deferred to the 2021 Vision Plan
    • The 2019 Federal Regional Transportation Plan adopted November 2019 to satisfy FHWA and FTA for funding purposes
    • The 2021 Regional (Vision) Plan
Model Application

• Cycle interruption significance
  – Update of the Series 14 Growth Forecast
  – Accelerated model development of ABM 2+
  – Project status uncertainty

– Back to the Executive Committee
Model Application

• Board policy
  – February 2020 Executive Committee
    • Staff options for coping with the cycle interruption
      – Follow the existing policy and deny new land use scenarios
      – Follow the existing policy and deny new land use scenarios after a grace period
      – Exception to allow new requests to start with ABM1 until the Vision plan is adopted
Model Application

• Recommended option implication
  – New land use model scenarios can begin with ABM 1 / Series 13
  – Limited use of the 2019 Federal RTP
    • Regional model data extraction
      – Select zone assignments
      – CAP, mode choice and SB743 VMT analysis
    • Custom network scenarios
    • No custom land use scenarios
Model Application

• Cycle update
  − Move ABM 2+ from development to application
  − Request for proposals (RFP) for subarea ABM 2+ enhancements
    • Employment density update
    • Reinstitute splitting of TAZs
    • Revamp the land use override procedure
      − Automate shadow pricing
      − Addition of new unit types
      − Pre-model run Person and Vehicle trip/tour reports
  • Popsyn update
  • Migration of existing subarea script reporting
  • Automation of QA/QC procedures
  • Reduce model run times
  • Trip data report and threshold definitions
  • Application tests
Model Application
Priority Projects for 2020

Airport Ground Access
• Update to airport model component
• Site land use
• Ground access

SR 11 Otay Mesa East Port of Entry
• Cross border travel survey
• Updated Traffic and Revenue model
• Investment grade study

2021 Regional Plan / Sustainable Communities Strategy (SCS)
• 5 Big Moves
• EIR
• SCS GHG targets
<table>
<thead>
<tr>
<th>Model Application</th>
<th>2020 Focus Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation Network Editing Tool</td>
<td></td>
</tr>
<tr>
<td>Dissemination of Information</td>
<td></td>
</tr>
<tr>
<td>Sub-Regional Modeling for ABM 2+</td>
<td></td>
</tr>
<tr>
<td>Dynamic Traffic Assignment (DTA)</td>
<td></td>
</tr>
</tbody>
</table>

- **Transportation Network Editing Tool**
  - Updated framework for TCOVED

- **Dissemination of Information**
  - TFIC (+ Transit)
  - Website & Documentation
  - Traffic Count Database (MS2)
  - CAP Data
  - Other

- **Sub-Regional Modeling for ABM 2+**
  - Service Bureau enhancements

- **Dynamic Traffic Assignment (DTA)**
  - Maintain and publish a current DTA model
Model Timeline

Data & Model Development

1966
- Comprehensive Planning Organization
- Series 1 Growth Forecast

1969
- The Coronado Bridge
- Polygon Information Overlay System

1970
- Grid Cell Allocation Program
- Mode Choice

1972
- First ADT Flow Map

1975
- MTS
- NCTD

1979
- Local Technical Assistance

1980
- Tranplan
- Series 6 Growth Forecast
- Arc/INFO
- San Diego Association of Governments

Policy & Model Application

The PRIME mainframe
Model Timeline

Data & Model Development

1982
SourcePoint

Series 7 Growth Forecast

1985
TransNet I

Travel Demand Model limits expanded to entire County

1987
I-15 HOV lanes (8-mile reversible)

Series 8 Growth Forecast

1988
RTP

Migration from PRIME mainframe to UNIX platform

1989
RTP Update

The Orange Line

1990

1991
Congestion Management Agency

Policy & Model Application
Model Timeline

Data & Model Development

- Development of a GIS application for network editing (TCOVED)
- Bridge Toll Authority
- Freeway Service Patrol
- Travel Behavior Survey
- Series 9 Growth Forecast
- (Not So) Brief Guide

Policy & Model Application

- RTP
- The Coaster
- RTP Update
- I-15 HOV lanes converted to HOT lanes
Model Timeline

Data & Model Development

2006
- RTP (Pathways for the future)
- Travel Behavior Survey

2007
- The Sprinter
- Series 12 Growth Forecast
- South Bay Expressway

2008
- SB 375
- Integrated Corridor Management (Cube)

2009
- I-15 Express lanes
- Truck Model

2010
- 4D Integration
- Integrated Corridor Management (TransModeler)

2011
- RP / SCS (Our Region, Our Future)
- Acquisition of South Bay Expressway

2012
- Series 13 Growth Forecast
- Activity Based Model 1

Policy & Model Application
Model Timeline

Data & Model Development

2013
- VMT White Paper

2014
- Integrated Corridor Management (Aimsun)
- Commercial Vehicle Model

2015
- Active Transportation Networks
- ABM 1 Land Use Overrides

2016
- Travel Behavior Survey
- Dynamic Traffic Assignment
- Migration from TransCAD to EMME

2017
- AB 805

2018
- Activity Based Model 2
- Regional Count Database
- SB 743

2019
- Peer Review Panel
- Series 14 Growth Forecast
- RTP (Federal)
- Agency Reorg

Policy & Model Application

Cross-Border Terminal
RP / SCS (San Diego Forward)
Model Timeline

Data & Model Development

Activity Based Model 3

Series 15 Growth Forecast

Travel Behavior Survey

2020
- Dynamic Traffic Assignment Workshop
- RP / SCS (The Vision Plan)
- Midcoast

2021
- FutureScape
- ABM 2+ Land Use Overrides

2022

2023

2024
- RP / SCS (TBD)

2025

2026
Dynamic Traffic Assignment (DTA)

• Introduction to the San Diego DTA Webinar
  – What is DTA
  – Coverage: Area & Time
  – Devices
  – Demand
  – Usage of the model
    • Micro-level use case
    • Meso-level use case
  – Things to know

• Hands on Training Workshop
  – How to use the model
  – How to update the model
  – Modeling exercises
Surveys in 2019

• Statewide Ride-hailing survey (SB1 TNC Survey)
  – Grant-funded project from Caltrans
  – “The Future of Mobility: Analyzing the impact of ride-hailing on California communities”

• 2019 Cross-Border Survey
  – Funded by SANDAG
  – Continuous study of traffic conditions at the US-Mexican Border
Statewide Ride-Hailing Survey

• Study Overview
  – Objective: Inform long-range transportation and land use planning, investment decisions and policies
  – Sample Target: 12,500 or more complete travel days and 1,350 TNC samples
  – rMove smartphone app: ask who, why, how, when and where
  – Validated technology and project methodology
Statewide Ride-Hailing Survey

• Survey Methodology
  – Travel data for a one-week period
  – Contents
    • “Signup Survey” – household composition, demographics and vehicles
    • Trip surveys after each trip
    • Daily surveys after each travel day
  – “Complete” participants
    • Demographic sufficient
    • Complete surveys for one or more days
Statewide Ride-Hailing Survey

• Data Collection – San Diego County

- 2380 household
- 4800 person (2800 completed one+ days)
- 3555 vehicles

- 17,210 complete travel days
- 90,080 complete trips
- 1,820,330 trip locations
- 1550 TNC trips
Statewide Ride-Hailing Survey

Statewide Ride-hailing Survey (SB1 TNC Survey) – Household

Household-Level Data Table Description

- hh_id
- Travel dates
- Home location variables
- Home location geography variables
- Number of trips reported by household during the travel periods
- Household income variables
- Number of full-time workers
- Number of part-time workers
- Number of university students
Person-Level Data Table Description

- person_id
- School and work location variables
- Missing derived school and work locations
- School and work location geography variables
- Date and time active rMove
- Shared mobility use
- Number of trips reported by person during the travel period
- Number of complete day for persons during the travel period
### Statewide Ride-hailing Survey (SB1 TNC Survey) – Vehicle

<table>
<thead>
<tr>
<th>vehicle_id</th>
<th>sample_segment</th>
<th>sample_stratum</th>
<th>make</th>
<th>model</th>
<th>year</th>
<th>vehicle_name</th>
<th>home_park_pass</th>
<th>home_park_cost</th>
<th>home_park_amour</th>
</tr>
</thead>
<tbody>
<tr>
<td>195000057101</td>
<td>3</td>
<td>12</td>
<td>BMW</td>
<td>3 series</td>
<td>2007.0</td>
<td>2007 BMW 3 series</td>
<td>2</td>
<td>995</td>
<td></td>
</tr>
<tr>
<td>195000057102</td>
<td>3</td>
<td>12</td>
<td>Ford</td>
<td>Focus</td>
<td>2010.0</td>
<td>2010 Ford Focus</td>
<td>995</td>
<td>995</td>
<td></td>
</tr>
<tr>
<td>195000093101</td>
<td>3</td>
<td>11</td>
<td>Honda</td>
<td>Accord</td>
<td>2009.0</td>
<td>2009 Honda Accord</td>
<td>2</td>
<td>995</td>
<td></td>
</tr>
<tr>
<td>195000093102</td>
<td>3</td>
<td>11</td>
<td>Toyota</td>
<td>Camry</td>
<td>2010.0</td>
<td>2010 Toyota Camry</td>
<td>2</td>
<td>995</td>
<td></td>
</tr>
<tr>
<td>195000109101</td>
<td>3</td>
<td>14</td>
<td>Toyota</td>
<td>Camry</td>
<td>2009.0</td>
<td>2009 Toyota Camry</td>
<td>2</td>
<td>995</td>
<td></td>
</tr>
</tbody>
</table>

### Vehicle-Level Data Table Description

- Vehicle_id
- Vehicle year, make, and model
- Other vehicle information (primary vehicle)
  - Home park time and cost
  - Toll transponder availability
  - Fuel
Day-Level Data Table Description

✓ Person_id + Day_num
✓ Number of total trips
✓ Reason didn’t travel on travel date
✓ Day is complete
✓ Number of trips reported by person on travel date
Statewide Ride-Hailing Survey

Statewide Ride-hailing Survey (SB1 TNC Survey) – Location

Location-Level Data Table Description

✓ Trip_id
✓ Time collected
✓ Speed in meters per second
✓ Location accuracy in meters
✓ Heading in degrees
Trip-Level Data Table Description

✓ Trip_id
✓ Origin and destination trip purpose
✓ Departure and arrival time
✓ Trip duration, miles, speed
✓ Dwell time between trips
✓ Travel mode
Statewide Ride-hailing Survey

Survey Data Statistical Summary – San Diego County
Statewide Ride-hailing Survey

Mode Share from SB1 TNC Survey (weekday weighted)

- Car: 84.42%
- Walk: 10.89%
- Transit: 1.71%
- Other: 1.29%
- TNC: 0.78%
- Bike: 0.41%
- Long-distance passenger mode: 0.28%
- Shuttle/vanpool: 0.15%
- Bikeshare: 0.02%
- Carshare: 0.02%
- Scooter share: 0.02%
- Taxi: 0.00%
- Schoolbus: 0.00%

Percentage of Trips (weekday weighted)
Statewide Ride-hailing Survey

Emerging Mobility Mode Share from SB1 TNC Survey (weekday weighted)

- TNC: 93.44%
- Bikeshare: 2.60%
- Carshare: 2.03%
- Scooter share: 1.94%
Emerging Mobility Mode Choice by Age
(weekday weighted trips)

- 75 years or older
- 65-74 years
- 55-64 years
- 45-54 years
- 35-44 years
- 25-34 years
- 18-24 years

Graph shows the percentage distribution of TNC, scootershare, carshare, and bikeshare trips across different age groups.

SANDAG
Emerging Mobility Mode Choice by Destination Purpose
(weekday weighted trips)

- **Change mode**
- **Errand/other**
- **Social/recreation**
- **Meal**
- **Shop**
- **Escort**
- **School**
- **Work-related**
- **Work**
- **Home**

![Bar chart showing the percentage of trips for different purposes, categorized by mobility mode: TNC, scootershare, carshare, and bikeshare.](image-url)
Statewide Ride-hailing Survey

Emerging Mobility Mode Choice by Day of Week
(weekday weighted trips)

- **Thursday**
  - TNC: 30%
  - Scootershare: 25%
  - Carshare: 45%
  - Bikeshare: 0%

- **Wednesday**
  - TNC: 15%
  - Scootershare: 20%
  - Carshare: 40%
  - Bikeshare: 5%

- **Tuesday**
  - TNC: 50%
  - Scootershare: 25%
  - Carshare: 20%
  - Bikeshare: 5%

- **Monday**
  - TNC: 10%
  - Scootershare: 15%
  - Carshare: 20%
  - Bikeshare: 55%
2019 Cross-Border Survey

• Project Overview
  – Update SANDAG’s Activity Based Model
    • Northbound crossers
    • Trip purpose
  – Collect information on Value of Time for Otay Mesa East
  – Collect data at three POEs: San Ysidro, Otay Mesa and Tecate
• Methodology and Sample Design
  – Cluster sampling
  – Distribution of crossings
  – Two-state collection design
  – Weekday vs. weekend interviewing
2019 Cross-Border Survey

Pilot Survey Summary

- Attrition rate is slightly better than anticipated - 77% vs 80%
- Participation in the second interview (i.e., accepted a diary) was much lower then 2010 – 15% vs 19%
2019 Cross-Border Survey

• Adjustments made based on pre-test
  – Several individuals attempted to turn in their diary shortly after crossing the border
  – The laptops used by Flagship staff on the US side of the border for diary retrieval would not connect to the Internet
  – One individual attempted to turn in a fraudulent diary, claiming he had received it earlier in the week and was reporting for travel behavior from a prior day
2019 Cross-Border Survey

• 2019 Cross-Border Survey
  Timeline
  – September 2019: Kick-off meeting, finalize project management plan, sampling plan, survey instrument and travel diary
  – October 2019 – January 2020: pilot test and survey at San Ysidro, Otay Mesa and Tecate
  – Early spring 2020: clean and validate data
  – Mid-spring: draft report
  – Late-spring: final report
Sketch Planning

• FutureScape
FutureScape™
Experiment with the Future.
FutureScape at SANDAG

What is FutureScape?
FutureScape™ is a sketch planning and simulation platform that creates digital replicas of large-scale systems such as entire cities or large industrial infrastructure to answer ‘what if’ questions about the future.

How is it being used at SANDAG?
A digital twin was created for the San Diego region to explore the impact of the Five Big Moves on VMT and Mode Choice using logic from the SANDAG Activity Based Model (ABM).

This tool is intended to complement the ABM by providing (1) a more agile means to assess impact of the Moves within comparable/ reasonable bounds of the ABM, and (2) a visual and dynamic interface for SANDAG users.
Methodology – Data Ingestion

Convert MGRA location field into latitude and longitude coordinate positions via building centroid points within each MGRA. Home and work locations for each user are held consistent.

Read in the ABM trip lists as provided, merging the joint and individual lists together

Convert time bin field into real times by sampling from a bounded uniform distribution. We ensure that activity chronology is maintained at the person level and that joint trips occur at the same time for co-travelers.

Read processed schedules into the FutureScape simulation. Agents will follow the trip list, which now has complete position and time data.
Methodology – Process Flow

- **INPUTS**
  - Open Street Map
  - San Diego MTS + NCTD
  - Trip List
  - Synthetic Population

- **SIMULATION RUN**
  - Road Graph
  - Transit Locations and Schedules
  - Routing
  - Utility Function (path + distance + time + cost)
  - Persona-based Coefficients
  - Mode Decision

- **OUTPUTS**
  - Simulation Logic
  - Mode Assignment to Agent
  - Aggregate Outputs for Analysis (VMT, mode choice distribution, road KPIs, etc.)

Legend:
- Existing functionality
- Modified or added for SANDAG
Impact to Date

Strong Alignment and Calibration to SANDAG Standards
Calibrated the model against SANDAG’s activity based model and arrived at very strong alignment with less than 0.3% variance on key metrics tied to calculating miles traveled (VMT) as a result of travel / mode choice decisions made by agents in the simulation.

Scenarios for the Five Big Moves
Running scenarios for each of the Five Big Moves to understand the impact on Vehicle Miles Traveled (VMT) and Mode Choice. This involves assessing ridership on new transit lines, use of flexible/ shared fleets in certain shed areas, and volume of ride-alone trips by car with changes to the road network and pricing.

Demonstrating Due Diligence and Use of Data
Participated in public outreach and executive meetings to brief preliminary results and illustrate how SANDAG is using advanced analytics and making data a central part of their decision making process for the 2021 Regional Plan.
FutureScape Demo

FutureScape Sketch Planning for the San Diego Region
Questions?
How to Model the 5 Big Moves
Joel Freedman (RSG)
SANDAG Model Users Group Meeting

SANDAG ABM2+ Enhancements

December 11, 2019
Topics

- Treatment of TNCs, AVs
- Telecommute model
- New transit mode
- Micro-mobility
- Toll simplification
- Other enhancements
Modeling Challenges

• Characteristics of new and emerging modes
  – Limited observed data
  – Limited opportunity for analogy
  – Potential for transformative changes in travel

• Traditional single-point forecasts ineffective for exploring potential outcomes

• Scenario testing preferred
  – Multiple runs with systematically varied parameters
Treatment of AVs

• Extension of vehicle ownership model
  – Human-driven versus autonomous vehicles

• Vehicle type availability
  – For households with both HV and AV – is an AV available for the tour?

• AV-specific mode choice parameters (if AV available)
  – Lower minimum age for drive-alone
  – In-vehicle time sensitivity
  – AV-specific auto operating cost, parking cost, terminal time
  – Mode-specific constant

• Assignment
  – PCE-specific factors for AVs
Vehicle Type Extension

- 0 Autos
  - Human-Driven
  - 2 HVs
- 1 Auto
  - Autonomous
  - 2 AVs
- 2 Autos
  - 3 HVs
  - 3 AVs
  - 1 HV 2 AVs
- 3 Autos
  - 2 HVs 1 AV
- 4+ Autos
  - 4+ HVs
Explanatory variables for AV ownership

• Demographics
  – Age (-), income (+)
  – May not be temporally stable

• Work accessibility

• Alternative-specific constants
  – “Calibrated” to represent different assumed private AV fleet penetration rates (10%, 50%, 90%)
  – And auto ownership percentages based on assumed potential for increased car-sharing across household members (-10%, -25%, -50%?)
Transportation Network Company Enhancements

• Effects of TNC availability on auto ownership
  – Via addition of TNC nest to transit accessibilities

• Extension of mode choice
  – TNC-transit utility similar to KNR-transit
  – Mobility-as-a-service nest
    • Taxi, TNC-single, TNC-shared (pool)
    • User-configurable wait time and cost functions
    • Time from skims derived from auto network
  – Alternative-specific constants to reflect non-included attributes
    • Calibrated to TNC survey
    • Provides another ‘lever’ for scenario testing
Wait Time Distributions

Source: City of Portland, 2015

<table>
<thead>
<tr>
<th>Density Range</th>
<th>Average Wait Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High 100000000</td>
<td>Low 15000 Taxi 5.5 TNC 4.7</td>
</tr>
<tr>
<td>15000</td>
<td>5000 Taxi 9.5 TNC 6.3</td>
</tr>
<tr>
<td>5000</td>
<td>2000 Taxi 13.3 TNC 8.4</td>
</tr>
<tr>
<td>2000</td>
<td>500 Taxi 17.3 TNC 8.5</td>
</tr>
<tr>
<td>500</td>
<td>0 Taxi 26.5 TNC 10.3</td>
</tr>
</tbody>
</table>

- Density = (Pop + Emp)/Sq. Mi
- Samples from distribution based on origin MAZ density
- Shared TNC distribution asserted
- Wait times to be estimated from TNC survey
- Mean\SD could be informed by simulation
## Taxi and TNC Costs

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Taxi</th>
<th>TNC-Single</th>
<th>TNC-Shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Fare</td>
<td>$2.20</td>
<td>$2.20</td>
<td>$1.00</td>
</tr>
<tr>
<td>Cost per mile</td>
<td>$2.30</td>
<td>$1.33</td>
<td>$0.50</td>
</tr>
<tr>
<td>Cost per minute</td>
<td>$0.10</td>
<td>$0.24</td>
<td>$0.24</td>
</tr>
<tr>
<td>Minimum cost per trip</td>
<td>0</td>
<td>$7.20</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

- Base-year costs to be updated based upon results of TNC survey
- Future year cost assumptions can be tested
- Does not take into account surge pricing, except could be assumed for special event modeling
Vehicle Routing Algorithm

• Initially developed to answer the question:
  – “How big would a shared TNC fleet have to be in order to serve all of the person trips in San Diego County?”

• A shared autonomous vehicle routing algorithm with the following features:
  – Reasonable approximation of real-world shared AV routing algorithms
  – Estimate vehicle fleet size
  – Takes trip list from SANDAG activity-based travel model as an input
  – Outputs a vehicle trip list that can be assigned to transport network to estimate impacts (congestion, VMT, etc.)
  – Generates empty vehicles
  – Rapid development, reasonable runtime
Time-based Greedy Algorithm

• Vehicles are generated on-demand and filled them up with passengers according to their departure time and origin\destination
• Vehicles are filled subject to constraints (out-direction travel, occupancy)
• Empty vehicles are placed in idle queue and wait for passenger requests within a max distance
• Passenger-less trips generated by relocating vehicles
• Passengers are re-routed to “hotspots” for greater efficiency
• Vehicles refuel\recharge according to user-specified parameters
Preliminary Results

- Approximately 420k vehicles to serve 11.5M person trips
- That is a ~5x decrease in fleet size
- Vehicles traveling ~150 miles on average
- +16% average occupancy over input trip list.
Telecommute Model

- Based on telecommute question in 2016 HH Survey
- Explanatory variables include occupation, income, person type, number of autos, number of adults in HH, presence of children, distance to work, whether worker pays to park at work
- Outcome of model affects daily activity pattern model and non-mandatory tour frequency model
Modeling approach

- Added new ‘fast’ transit mode to EMME
- Station-station times and headways coded explicitly (required for modeling)
  - Actual wait times may require iterating with demand depending on assumed vehicle capacities
- Allowed to compete in ‘premium’ and ‘premium+local with transfer’ mode alternatives
- Fast transit time & distance skimmed separately and can be used to apply transit-specific constants in mode\path choice
  - Suggest scenario testing between 15 minutes and 60 minutes of benefit
  - more benefit is more similar to commuter rail, would be applied based on duration of trip
Micro-mobility

- E-bikes, e-scooters
- Modeled via walk mode and walk leg of transit trips
  - Walk times input to model are minimum of walk or micro-mobility generalized time
  - Trip mode choice model applied to walk trips to estimate micromobility demand
  - Calibrated to data from City of San Diego and trip length frequency distribution from Salt Lake City

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk speed</td>
<td>3</td>
<td>MPH</td>
</tr>
<tr>
<td>Micro speed</td>
<td>15</td>
<td>MPH</td>
</tr>
<tr>
<td>Micro cost</td>
<td>$0.50</td>
<td>per mile</td>
</tr>
<tr>
<td>Micro wait time</td>
<td>3</td>
<td>minutes</td>
</tr>
<tr>
<td>Micro constant</td>
<td>10</td>
<td>minutes</td>
</tr>
<tr>
<td>Time Value of Money</td>
<td>4</td>
<td>MPD</td>
</tr>
</tbody>
</table>

![Walk Time Versus Equivalent Micro-Mobility Time](image_url)
Toll Choice Simplifications

• Recent SHRP 2 C04 enhancements included segmenting assigned trip tables by three value-of-time bins
  – But, toll/non-toll choice left in model, resulting in 30 assignment classes

• RSG tested elimination of toll/non-toll choice in mode choice, compared results to volumes on I-15 and SR-125
  – Note: transponder ownership segmentation for SOVs (for I-15 use)

• Resulted in little change to I-15 but significant improvement in demand estimation for SR-125

• Also shorter runtime, less disk space required
Estimated SR-125 volumes after collapsing toll choice much closer to observed
Revised mode choice model

Auto
- Drive Alone
- Shared 2
- Shared 3+

Non-Motor
- Walk
- Bike

Transit
- Walk Transit
- PNR Transit
- KNR Transit
- TNC Transit

MaaS
- Taxi
- TNC Single
- TNC Pooled

School Bus
Other Enhancements

- Simplification of mode choice logsum calculation for destination choice
- User enhancements around specification of toll costs and occupancy restrictions by time-of-day
- Automation of toll transponder model inputs
- Automation of ‘4d’ input calculations
Questions
Joel Freedman
Senior Director
Joel.freedman@rsginc.com
503.200.6602

www.rsginc.com
Forums Agenda Recap

• Welcome, Introductions and Announcements
• Model Roadmap
  – Development
  – Application
  – Surveys
  – Sketch Planning
• How to model the 5 Big Moves